Corrosion Resistant Materials for Molten Metal Processing Can Lead to Significant Energy and Production Benefits

In the processing of coated steel sheet there is severe corrosion of components (rolls etc.) under the molten metal coating bath. The outages (every one to three weeks) result in significant energy losses due to reduced product quality/yield prior to shut down and to the need to maintain associated furnaces etc. operating while not producing product.

Laboratory scale corrosion research on new and currently used materials performed by West Virginia University, Oak Ridge National Laboratory, and University Missouri-Rolla, along with industrial partners, has led to an understanding of the dynamic corrosion which occurs on steel galvanizing rolls with respect to dross formation. Through this work, for the first time, researchers have identified the relationship between laboratory and industrial dynamic corrosion with respect to the formation of dross on roll surfaces. The average dross particle size of 33 microns as obtained from laboratory tests (see Fig.1) compares extremely well with results from industrial scale trials (35 microns).

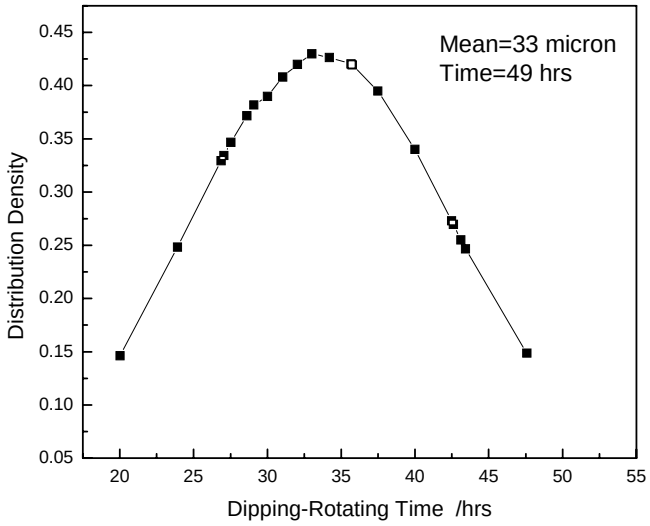

Figure 1. Dross Particle Size Distribution (Dynamic Laboratory Scale Testing)

The knowledge gained is enabling the development of new corrosion and wear resistant materials with greater than 5X lifetime improvement. Results from experiments have been validated through the exposure of iron-based alloy weld-overlay material specimens for over 33-days in an industrial setting (see Figure 3).

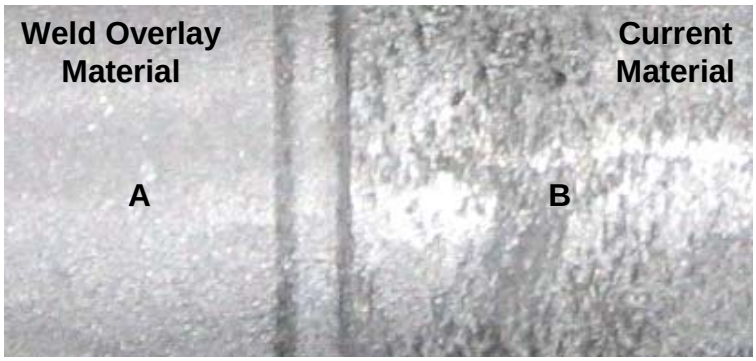

Figure 3. An As-Tested Exposure Specimen
A – Non-Wetting Surface on Newly Developed Material
B – Corrosion and Dross Formation on Current Material

The new materials are functioning very well with little corrosion evident. This success has resulted in the decision to extend the industrial test for an additional 27 days (60 days total). This would exceed the project goal of producing a material with 10X lifetime as compared to current materials (an extension of life from 4 to 40 days).

In addition, the weld-overlay process is currently being developed by a commercial roll supplier and project partner (see Figure 4.).

Figure 4. Roll with Weld Overlay of New Material – Prior to Machining

The resulting new roll is scheduled to be installed in the next two months for testing at an industrial production steel coating processing line. It is estimated that a total energy savings of over 2.2 trillion Btu per year will result in the coated steel industry from new materials development associated with this project.

A factsheet on this project is available at:
http://www.eere.energy.gov/industry/imf/pdfs/16943_metallic_and_refrac.pdf

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